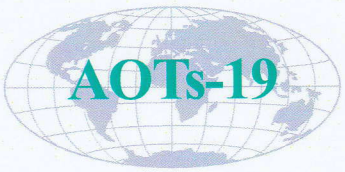
The 19th International Conference on

Advanced Oxidation Technologies for Treatment of Water, Air and Soil



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The Application of Electrofenton and Heterogeneous Photocatalysis on the Degradation of Anti-Inflammatory Drugs Mixture

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Several compounds have been identified in some effluents that wastewater treatment plants (WWTP) cannot totally remove. Many of these compounds are pharmaceuticals products, which are not regulated by environmental laws. Among the most consumed drugs in the world, non-steroids anti-inflammatory drugs have been detected in both superficial and ground water. Advanced Oxidation Processes (AOPs) are an excellent alternative as pre-treatment or as final treatment to degrade these compounds in wastewater. They are based on the production of highly reactive species like the hydroxyl radicals HO• which can oxidize organic matter that allow complete mineralization. Electrochemical methods as electroFenton and anodic oxidation belong to AOPs. These have been evaluated on the degradation of several organic compounds. One of the most efficient anodes used for electrochemical process is Boron Doped Diamond (BDD) electrode. Advantages of this electrode is its high chemical and electrochemical stability and self-cleaning. On the other hand, heterogeneous photocatalysis is another AOP method that basically consists in the photo-activation of a semiconductor using UV-Vis light. We present here preliminary results of the NSAID mixture oxidization (naproxen, ibuprofen and diclofenac) by electroFenton and Photocatalytic processes. In both oxidation processes, 5 mg L^{-1} each drug in aqueous media was degraded. In the electroFenton, BDD electrodes (anode and cathode) were used. The best conditions were established in both treatments by full factorial experimental design. For electrochemical method, current density (40 mA cm^{-1}) and Fe^{2+} concentration (3 mmol L^{-1}) were the optimal conditions. For heterogeneous photocatalysis, degradations were conducted in aqueous solution at different experimental conditions such as light source (365 nm lamp and solar light), pH (acid and neutral) and catalyst type (TiO_2 and ZnO). All degradations were evaluated by UV-Vis spectroscopy and measurements of total organic carbon (TOC) content. The results using photocatalytic treatment showed that higher activity was obtained with TiO_2 catalyst and solar light as irradiation source. Using TiO_2 as catalyst, the pH value did not affect the degradation process. This result is an important finding for its application in WWTP effluents where pH value can vary. In these preliminary results, the removal efficiency was 79 %, by electroFenton and 96 % by heterogeneous photocatalysis after 3 hours. In the same degradation time, TOC removal was higher using electroFenton method (92 %) than those obtained by heterogeneous photocatalysis (64 %). However, both treatment processes showed to be effective on the removal of these compounds and could be an attractive alternative as tertiary treatment in WWTP.